



## EFFECTS OF FERTILIZER STARTER PELLETS ON GROWTH AND MORTALITY OF PLANTED SEEDLINGS ON MOUNTAIN HOME DEMONSTRATION STATE FOREST

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Figure 1. Test plot on Mountain Home Demonstration State Forest comparing growth of fertilized and non-fertilized seedlings.

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## INTRODUCTION

Fertilizer starter pellets have been used in forestry and agriculture in an attempt to increase growth and survival of newly established trees, vines, and perennial crops. The long range effects of these pellets on conifer tree planting has been largely undemonstrated. The objective of this study was to answer two basic questions: Can early fertilization increase height growth of planted seedlings? Will the fertilizer pellets have an effect on short or long term mortality?

This report summarizes three field trials started in 1965-67 by Floyd L. Otter\* in which orchard type fertilizer pellets were investigated for their effect on newly planted seedlings. The trials were at an elevation of 5500 to 6600 feet in the Mountain Home Demonstration State Forest, Tulare County. The conifer species studied were: California red fir (Abies magnifica); Scotch pine (Pinus sylvestris); ponderosa pine (Pinus ponderosa); and Jeffrey pine (Pinus jeffreyi). The pellets were of the size commonly sold as "grape pellets". The pellets were only partially water soluble to allow for a slow nutrient release. The chemical analysis was listed as 28% nitrogen derived principally from urea formaldehyde, 8% phosphorus from superphosphate, 4% potassium, 1% iron, and 0.2% zinc. The data were analyzed statistically using a T test for unpaired observations and unequal variances.

### Trial Number 1

156 seedlings of the four species were planted in 1965 at an old log landing at 6600 foot elevation. The soil was described as "fast draining, infertile, very fine sand with little organic matter."<sup>2/</sup> This was a result of the log landing's construction. The topsoil was either removed or mixed with the subsoil. One half of the trees were fertilized by placing a pellet two-thirds of the way down in each planting hole. Soil was placed between the pellet and the roots to prevent root burn. The other half were unfertilized controls. A mortality survey conducted the first autumn after planting indicated the pellets might be causing above normal first year mortality. Survival of the fertilized trees was 87%; 99% of the controls survived.<sup>1/</sup> This trend did not continue. Survival by 1980 was 71% for the control and 68% for the fertilized. Growth information for the plot is summarized in Table 1.

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Figure 2. Forest personnel measuring a fertilized ponderosa pine in 1972, seven years after planting.

Table 1. Average Height in Feet for Fertilized and Non-fertilized trees for Trial #1

SPECIES	1967 <sup>1/</sup>		1972 <sup>1/</sup>		1980	
	Con.	Fert.	Con.	Fert.	Con.	Fert.
Red fir	.75*	1.05*	1.96*	2.70*	4.49	6.45
Scotch pine	.99*	1.27*	3.47*	4.53*	11.20	11.88
Ponderosa pine	1.23*	1.46*	4.42*	5.76*	11.67*	13.87*
Jeffrey pine	.83	.98	3.95	3.88	11.01	9.39

\*Height difference between fertilized and unfertilized significant at the 90% confidence level.

#### Trial Number 2

Approximately 100 red fir and 100 ponderosa pine were planted at an elevation of 5500 feet on a steep cleared site. The soil is a deep loam of the Chawanakee series, Dunning's site Class 1.<sup>3/</sup> One half of the trees were fertilized with a pellet placed in the planting hole; the other half were unfertilized controls.

Because of mass soil movement and losses to unknown causes, survival percentages on this plot are unreliable. Growth information is tabulated in Table II.

Table II. Average Height in Feet for Fertilized and Non-Fertilized Trees in Trial #2.\*

SPECIES	1967		1980	
	Control	Fertilized	Control	Fertilized
Red fir	.61	.46	8.07	6.62
Ponderosa pine	1.09	.95	19.41	21.45

\* Note: None of the height differences are statistically significant at the 90% confidence level.

### Trial Number 3

In 1967, 480 red fir seedlings were planted at the 6500 foot elevation in the most extensive of the fertilizer trials. The soil is a deep loam of the Shaver series, granitic parent material, Dunning's site Class IA.<sup>3/</sup> The test was to determine if the position of the pellet in the planting hole had an effect on mortality. 360 seedlings were fertilized using three placement positions: 1) pellet placed 2/3 down in the planting hole adjoining or very close to the roots (2/3 close); 2) pellet placed 2/3 down in the hole with one inch or more of soil between the pellet and the roots (2/3 far); and 3) pellet placed in the bottom of the hole with about one inch of soil between the pellet and the roots (deep). The remaining 120 trees were unfertilized controls. The competition from invading vegetation was severe. Survival percentages are summarized in Table III.

Table III. Effect of Fertilizer Pellet Placement on Percent Survival for Red Fir in Trial #3.

TREATMENT	1968 <sup>1/</sup>	1980
Control	70%	60%
2/3 Close	73%	60%
2/3 Far	73%	67%
Deep	66%	53%

Height growth data were obtained for all trees in 1968 and 1980. In both measurement years no significant differences could be found in total height growth between fertilized trees with different pellet placements or between all fertilized trees and the unfertilized controls.

## Conclusions

These three trials show mixed results concerning the performance of fertilizer starter pellets. The pellets may cause some additional first year mortality as shown in Trial #1. This mortality was not severe and did not appear to continue in later years. Pellet placement in relation to tree roots showed no significant difference in tree mortality in Trial #3.

Significant increases in growth with fertilization were evident in only one trial (See Table I). This was on a soil of low fertility. This may indicate that a site must have nutrient deficiencies before fertilization will increase growth. These growth differences become less evident with time. Only one species, ponderosa pine, had significant height differences after 15 years. Jeffrey pine exhibited no response to fertilization throughout the test period. This contrast in response may be due to their differing tree physiology. Jeffrey pine can tolerate low nutrient levels and ponderosa pine is intolerant of nitrogen deficiencies. <sup>4/</sup>

Individual planting sites should be evaluated thoroughly before fertilization is undertaken. Soil testing may be appropriate to determine if nutrient deficiencies exist. Tree species should be selected considering their various growth responses to changes in soil fertility. Fertilization may be beneficial to trees needing accelerated initial growth to become established over competing vegetation. Christmas trees with short rotations may also benefit from early fertilization. In general, fertilizer starter pellets show promise for increasing growth for selected species on sites with soils of low fertility.

## References

1. Otter, Floyd L. and Schoenheide, Richard L., 1972. Summary of Fertilizer Pellet Experiments on Mountain Home State Forest. Unpublished.
2. Sierra Chemical Company, October 1969. Effect of Tree Starter Fertilizer Still Visible after Six Years.
3. Cooperative Soil-Vegetation Survey, 1968. Mountain Home State Forest Soil-Vegetation Map.
4. Minore, Don. June, 1979. Comparative Autecological Characteristics of Northwestern Tree Species - A Literature Review. U. S. D. A. Forest Service, General Technical Report, PNW-87.



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